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SOME PRESSING PROBLEMS IN THE DEVELOPMENT AND INTRODUCTION OF NEW RADIO TECHNIQUES

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The development of new industrial centers, the bringing of new areas of virgin and waste land under cultivation, and the general rise of socialist culture in our country insistently demand that all kinds of communications be most rapidly provided the population and the national economy. Inadequate provision of communications holds up the development of economic centers and deprives the population of essential conveniences. The organization of communications in new districts as a rule must precede the development of industry and agriculture. For successful accomplishment of this task, it is necessary to utilize in every way the latest achievements in the field of the technology of communications. It is expedient to send to the new districts equipment simple to operate and maximally automated, not requiring the constant duty of operating personnel.

This article has the aim of directing the reader's attention to certain trends of scientific-research work which have not as yet been sufficiently recognized. One of them is the installation of radio-relay lines in the new districts of the country. The possibility of dispensing with the shipment of numerous train loads of timber for erecting aerial lines of communication has important significance. However, because of their high costs, the existing radio-relay lines cannot successfully compete with the usual pole line. The explanation for this is that the principle put at the basis of their development was the creation of equipment for the principal main lines of communication in which as a rule a high degree of operational reliability was provided, since with a mighty stream of traffic passing through the main lines even brief interruptions entail great losses. Therefore, the equipment installed on these lines permits rapid transition to reserve stands and to reserve supply. The line as a whole is calculated with a big reserve of power, which substantially heightens the total cost of the main line.

A different approach should be made with respect to the creation of equipment for the less responsible main lines, where the number of communication channels and their traffic load over the 24-hour period is not great. There is no doubt that in developing equipment for these mains, technical demands can be considerably lowered. Thus, for example, it is possible to do without installations of reserve sets of equipment and power supply sources; the rated magnitudes of the line's operational stability can be somewhat reduced. This will allow for a substantial reduction in the costs of erecting the main line and will simplify its operation. For a line with little traffic it is wholly possible to permit during the 24-hour period transitory reductions of indexes. The number of channels of the simplified equipment must not be great; in a number of cases it can be limited to the simplest equipment of packing in 3 to 4 channels. Creation of the simpler antennae will permit attaching them to masts with guys instead of employing free standing towers, which will also bring about substantial reduction in the cost of the main line. For districts unprovided with electricity, the question should be specially examined of creating equipment that consumes the minimum quantity of electric power. The elaboration of such equipment, designed for rapid establishment of communications with sparsely inhabited districts, is a very honorable assignment, no less important than the creation of the most complex equipment for outfitting the multichannel

radio-relay lines of communications. The creation of equipment of simplified type requires almost no additional scientific research work, being essentially an interesting designer's job. The output of such equipment by industry for outfitting "small" radio-relay lines will open the way for wide use of this kind of communication in many branches of the national economy.

The new trend in the technology of production of equipment, known under the name of "miniaturization" /midget-sizing/, should contribute to the rapid development of radio-relay lines, chiefly main lines. The creation of intricate devices in which scores and hundreds of electronic tubes are used insistently demands the output of radio parts of minimal dimensions. How great the need is can be seen if only in the example of multichannel equipment of packing. The ordinary 12-channel system consists of 7 standard stands more than human size in height. The interconnection of 12-channel groups into 60-channel ones, and the latter into still more multichannels creates exceptionally great piling of equipment. Consequently, at the terminal points of powerful multichannel main lines, big buildings have to be erected for interurban stations with equipment halls having hundreds of stands set up in long rows. Priority importance is therefore attached to solution of the problem of producing miniature details, which will make possible drastic reduction in the dimensions of equipment.

Combination of the equipment of ultrashort wave transmitters, radio-relay units, and local telephone stations with the object of maximal release of technical personnel, and reduction in the sizes of premises occupied by cable amplifiers, also requires diminution of the dimensions of equipment. Scientific-technical work directed to securing the output of miniature parts must be developed on a wide front, as solving great problems common for all branches of modern electronics.

It is no less important to propel work in the automation of communication installations. The raising of labor productivity can be attained not only by means of raising the technology of production, but also by release of operating personnel doing constant duty near equipment. The maximal automation of communications equipment is therefore one of the most important questions in the matter of raising the productivity of labor.

Despite the obviousness of this thesis and the wide automation that has already been carried out in the country's power supply system and on transportation, automation in the communications system has still virtually not received the proper recognition. If, for example, questions of automation are given adequate attention during the development of new equipment for radio-relay lines and also of packing equipment of wire lines of communications, then such questions are almost unthought of at the operating radio stations. Moreover, in the overwhelming majority of installations now developed and being developed, the possibility of their operation without service personnel is not foreseen. Meanwhile, for example, the standard television and ultra-short wave broadcast transmitters, operating from day to day on one and the same wave length and at one and the same duty, are extremely gratuitous material for accumulating experience in the creation of nonserviced equipment.

The assignment to industry issued by the Ministry of Communications on the elaboration of a nonserviced transmitter does not concretize with sufficient clarity the demands made, which leads to prolonged technical discussions and postpones the implantation of automation for a long period. Meanwhile, the existing type of 1-1/2-kw ultra-short wave station on tubes with air cooling can — by means of doubling — be used

already this year for the creation of a nonserviced 3-kw transmitter. For this purpose 2 identical transmitters each, the capacity of which fits in the circuit, must be installed in each point. When one of the transmitters gets out of order it is switched off, and the second continues to operate. At a signal, personnel come to station installation to correct the fault. The cutting down for some time of power to one-half is little noticed by the auditor. In order that such an installation be realized, it is necessary to work out a scheme of composition and equipment of signalling. The problem, it is relevant to say, is solved, and the only requirement is the creation of equipment applicable to a given concrete case.

The next problem subject to examination follows from the previous one. With wide installation of nonserviced equipment the problem is very pointedly raised of increasing the reliability and stability of the equipment operation. Nonserviced equipment must retain its technical indexes during the interval of time between 2 periodic inspections. In the first place the question of increasing the period of service of tubes must be solved, and methods must be created for determining the probable duration of their further operation.

The technician making the inspection of the equipment must have the possibility of determining the state of the tubes and other parts. In this direction certain solutions are in view; however, the available proposals were made in the most general form, whereas it is necessary to have available diverse portable testing equipment, by means of which the service personnel can rapidly check on the reliability of the further work of tubes, the state of wiring and the antenna-feeder line, the operating condition of all parts of equipment. The creation of such equipment will greatly increase the reliability of installation operation and in proportion to the accumulation of experience permit reduction of the number of reserve units.

Problems of further development of television attract at present intensified attention. Of great interest among other problems in the development of television is that of a maximal reaching of the population with transmissions of the telecenters already built. The modern television center is an extremely complex construction costing many millions of rubles. Moreover, expenditures on making up the programs are very substantial. Therefore, the installed equipment must be used for as large a television audience as possible. There are several possible ways of enlarging the audience of the television center. The simplest of them is the method of using rebroadcasting stations, situated in a ring at distances of 80 to 100 km from the leading base television center. Owing to the use of highly sensitive receivers and the installation of a high mast at the rebroadcasting center, the latter can receive television transmissions over a long distance. At the top of the mast 2 antennae are installed: a receiving and a transmitting one. The received television broadcast is transmitted anew through the local transmitter, owing to which the radius of reception of television is expanded from 60 to 120 to 140 km, embracing a considerable area with comparatively small additional expenditures.

Unfortunately, the installation of radio-relay television points is being held up in the USSR by the lack of equipment suitable for operation in a wide range of frequencies, and also the lack of television sets capable of receiving a large number of channels.

The operation of several rebroadcasting points around a base television transmitter requires the mastery for such a system of several frequency channels. Otherwise, it is not possible to secure reception

without mutual interference. Moreover, the simultaneous reception and transmission from antennae situated on one mast also requires a sufficient spread of frequencies. The problem raised is undoubtedly so timely that it is necessary for our industry to create now standard projects of rebroadcasting points, for which purpose solution of the problems of enlarging the frequency band of equipment and of organizing the production of television sets designed for reception of a large number of channels must be hastened. The latter problem must be solved either by the output of multichannel receivers or, what is simpler, by the replacement of the block of input coils of one channel with another block selected applicably to the channels of television used in the given district.

Somewhat more complex is the problem of transmitting television at a distance of 200 to 300 km from the main television center. In this case the transition is necessary to special radio-relay lines adapted for television transmission and operating on the principle of pointedly directed radiation. Of course, double rebroadcasting, designed according to the aforementioned principle, can be imagined. Besides, the power radiated by the first rebroadcast point can be received by the other, situated 80 to 100 km away from the first and entering a second concentric ring of rebroadcasting stations 320 to 360 km in diameter. However, such a method cannot as yet be recommended for television transmission, since there is the danger that the picture will be distorted by interferences. A second method, the transmission of pictures by means of radio-relay lines, is generally accepted and technically more perfected. Radio-relay lines operate, as a rule, in a range of frequencies that differ from the range of frequencies of the television stations, and have amplifier substations at distances of 50 km from one another. With the use of appropriate equipment the length of line can reach several thousands of kilometers. Television transmission in this case is usually combined with the transmission of telegraph and telephone messages. Considering the comparative complexity of such lines, it can be presumed that side by side with them simpler short segments of line will be built, designed for transmission of television only. This will permit more rapid servicing of wide circles of the population with television. The creation of short radio-relay lines (200 to 300 km long) is considerably simplified, if there is the possibility of reducing the total number of amplifier substations.

When the relief is level it is necessary for a line 200 km long to establish 3 booster points situated between 2 terminals. Where the terrain is broken the distance between 2 intermediate points can in a number of cases be increased through the use of natural elevations. In mountain regions when the line of communications goes along mountain ridges with steep slopes, practice records cases of reception of television at considerable remoteness from the place of transmission. This phenomena permits increasing the distance between 2 amplifier points. In those cases when a city is situated behind the mountain ridge, special antenna devices are employed, permitting the transmission of received electromagnetic energy downward to the city without installation of any kind of equipment on the summit. The use of these possibilities makes possible lowering the cost of radio-relay lines, and therefore the scientific-research institutions should study closely the systematizing of possible ways of increasing the distance between substations so as to give surveyors instructions on the use of natural elevations when laying out the route of lines being built.

The provision of the program to remote television centers not connected by radio-relay lines must be done by means of its recording. For this purpose 2 methods are proposed. One of them, the simpler and better known, consists in making a motion picture film of the programs

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of a large, well equipped television center. It should be noted that such recording of television transmissions, which we have successfully begun, has not been adequately developed, although the ever-increasing number of peripheral television centers urgently demands this.

Under the second method which however is not yet sufficiently elaborated, it is proposed to accomplish the recording of television signals on magnetic tape. For speeding the delivery of tapes to the local station, aviation should be used.

In conclusion, it is necessary to mention yet another trend of television development which has been recently projected. The presence in a number of cities of industrial radio enterprises, and also of a large body of radio amateurs and radio specialists stimulated the tendency to produce television equipment directly with local resources. There are all grounds for further expansion of this movement. However, the construction of television centers in the periphery without sufficient technical direction can lead to not only excess spending of forces and means, but also to the creation of inefficient television centers useless for prolonged operation.

The Technical Administration of the Ministry of Communications USSR is therefore obligated to utilize correctly the initiative that arises in local places. The administration must prepare and select the best technical models of equipment, create a standard project of the television center in 2 or 3 versions which provide for its gradual development. Thus, if in the initial period the television center can broadcast only motion-picture films, then at the next stage, after additional equipment is put into operation, various actual broadcasts can be realized, and also broadcasts from local theaters and clubs, after which a studio can be erected, etc.

It is very desirable that a printed manual be issued with description of the diverse variants of television centers and indications on the sequence of their development, and also the approximate cost. The availability of such a manual will raise the activity of wide circles of radio specialists in local places, help them to avoid mistakes, and at the same time hasten the development of television in the USSR.

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